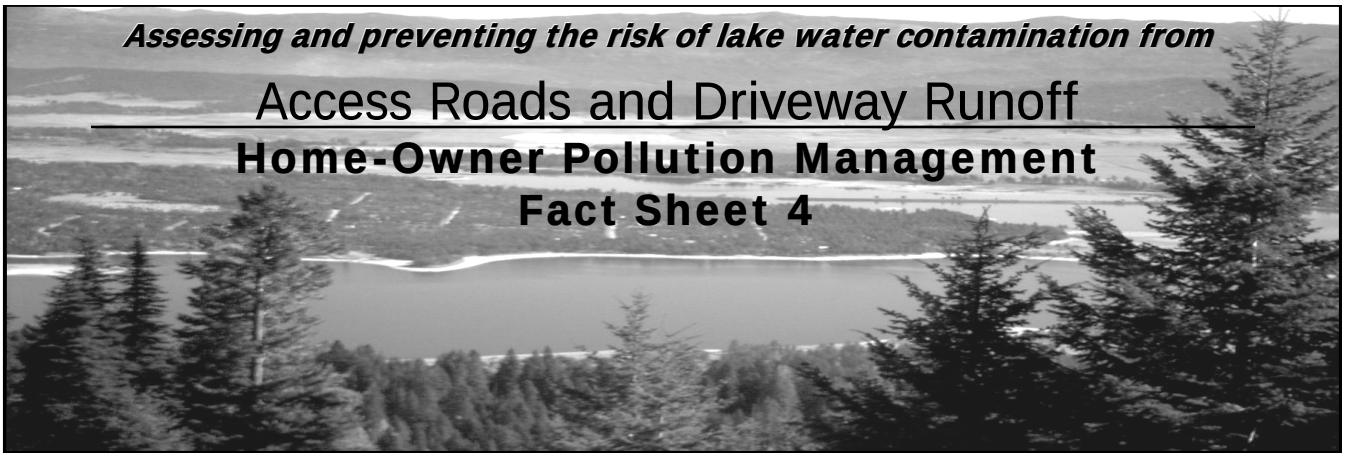


Public and Private Residential Roads

Roads may be considered pollutant sources to Lake Cascade and its tributaries due to the amount of sediment flowing into these waterbodies during storm and snow melt runoff events.

The public roads around Lake Cascade are either maintained by the United States Forest Service, the Idaho State Department of Lands, or by the Valley County Road Department. Homeowners are responsible for maintaining their private driveways.

How does a rut form and where does all that dirt go?

Most roads and driveways are constructed of compacted native soils. These dirt roads, if not properly managed, can get rutted after just a single storm. If a road is constructed properly, water from a storm event does not get a chance to pick up speed and create a rut. Water runoff is slowed down by control measures and diverted into vegetated drainage areas where the dirt is captured and the water is filtered back into the ground.

On the other hand, if a road does not have any runoff control practices in place, water runs freely downhill unchecked where it picks up speed and scours away the soil creating those car eating ruts. The runoff carrying suspended sediment (dirt) then flows into either the lake or one of it's tributaries. The addition of fine sediment into water bodies increases the loading of phosphorus, which is the limiting factor of algae production (algae blooms and algae on the rocks), and can cover fish spawning beds in streams. Ruts can also form by driving on dirt roads during spring thaw or during times when the roadbed becomes soft and muddy.

The information and intent of this Fact Sheet is to **only provide general guidelines** on proper road construction as it relates to water runoff and erosion control management on private roads and driveways. The expertise of a road design engineer or contractor and an experienced heavy equipment operator are essential in designing roads. In too many cases we have seen private roads constructed by a property owner who has insufficient knowledge and experience in these areas, and consequently either no BMPs are installed, or BMPs that are installed fail in the objective of proper water runoff management. The guidelines in this Fact Sheet should help you ensure that road building on your property is done in a proper manner to minimize the impact on Lake Cascade, streams, and wildlife. We also offer several maintenance guidelines which the property owner can undertake for long-term functioning of BMPs.

Excellent references on BMPs are include *Forestry for Idaho: BMPs – Forest Stewardship Guidelines for Water Quality,* and *The Valley County Handbook of Storm Water Best Management Practices.* This information is available for you to review at the Idaho Department. of Lands office or the Planning and Zoning office at the Valley County courthouse building

Road Construction BMPs

Many private roads and driveways have significant gullies which form each winter and spring. These gullies can serve as conduits to transport water carrying sediment directly into streams and Lake Cascade. Normally, plants and trees help hold the soil in place and prevent erosion, especially on steep slopes, but when existing vegetation is removed for road construction the bare soil that is exposed can be easily washed into Lake Cascade. Soil erosion can lead to structural damage, reduce soil fertility, and fill in road ditches. It harms Lake Cascade by causing excess sedimentation, killing aquatic bottom life, and disrupting spawning. The sediment, with accompanying nutrients, may lead to algae blooms and reduced aesthetic appeal. All of these potential problems are expensive to correct and more importantly, can be avoided by properly controlling erosion during the construction process. The following BMPs are used to control erosion during the construction process and for preventing erosion problems in the future.

Construction BMPs:

- Place temporary roads as far as possible away from streams, surface waters or wetlands.
- Construct roads in a manner that prevents debris, overburden, and excess materials from entering streams. Deposit excess materials outside of stream protection zones.
- Construct roads to Idaho Forest Practices Act (IFPA) standards. See 'Rules Pertaining to the Idaho Forest Pactices Act Title 38, Chapter 13 Idaho Code'. (www.idl.idaho.gov)
- Manage drainage at staging areas to prevent sediment from entering streams.
- Clear drainage ways of all debris, generated during construction or maintenance, that may interfere with drainage or impact water quality.
- When constructing road fills near streams, compact the material to settle it, reduce erosion, and reduce water entry into fill. Minimize snow, ice, frozen soil, and woody debris buried in embankments. Limited slash and debris may be windrowed along the toe of the fill to provide a filter near stream crossings.
- Construct road stream crossings or roads constricting upon a stream channel in compliance with the Stream Channel Alteration Law, Title 42, Chapter 38, Idaho Code.
- Gravel native surface roads

Stabilize Road Slopes:

- Where exposed material (excavation, embankment, waste piles, etc.) is erodible and may enter streams, *stabilize* it before fall or spring runoff by seeding, compacting, riprapping, benching, mulching, or other suitable means.
- Retain *outslope drainage* during or following operations and remove outside edge berms except those protecting road fills.
- Construct *cross drains and relief culverts* to prevent erosion. Minimize construction and installation time. Use rip rap, vegetation matter, down spouts, or similar devices to prevent erosion of fills. Install drainage structures on uncompleted roads **before** fall or spring runoff.
- Install a wooden *open-top box culvert* across the road grade to convey surface runoff and roadside ditch flows to the downslope side. This practice is an excellent substitute for pipe culverts on lightly used unpaved roads on steep grades of 6% or more. Make sure to clean out culverts regularly.
- Install *waterbars* for use as a temporary or permanent drainage practice on light-use, low-maintenance, unpaved roads. Waterbars should be placed above grade changes to prevent water from flowing down steeper portions of roads or skid trails.
- Construct the road with shallow, outward-sloping dips or undulations to collect surface runoff and convey it away from the road surface.
- Care should be taken to maintain trees and shrubs growing at the base of fill slopes.
- Mixing stumps and other vegetative debris into the road fill should always be avoided.
- **Design roads to balance cuts and fills or use full bench construction where stable fill construction is not possible.**

Most forest roads are built by excavating a road surface. Road design and layout on-the-ground show machine operators the proper cut slopes and indicate cut slope steepness. The bulldozer starts at the top of the cut slope, excavating and sidecasting material until the desired road grade and width is obtained. Material from cuts is often pushed or "drifted" in front of the blade to areas where fill is needed. Road fill is used to cover culverts and build up flat areas. Since fill must support traffic, it needs to be spread and compacted in layers to develop strength.

Stream Crossings:

Any roads that include stream crossings that will affect the area below the mean high water line will require a 404 permit from the US Army Corps of Engineers and a Stream Alteration Permit form the Idaho Department of Water Resources.

For information on 404 permits contact:
The Army Corps of Engineers
Boise Regulatory Office
304 North 8th Street, Rm 140
Boise ID 83702
Phone: (208) 345-2154

For information on Stream Alteration Permits:
www.idwr.gov

While cut-and-fill construction is common for gentle terrain, full-bench roads are usually built on slopes over 65%. In full-bench construction, the entire road surface is excavated into the hill. The excavated material is pushed or hauled to an area needing fill or to a disposal area.

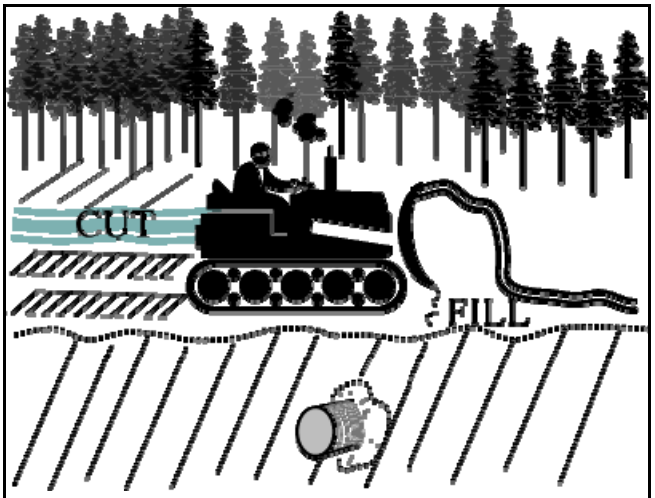
During the process of cut-and-fill, it is critical to avoid letting sidecast or waste material enter streams or placing it on unstable areas where it might erode.

- Minimize sediment production from borrow pits and gravel sources through proper location, development, and reclamation.
- Place debris, overburden, and other waste materials associated with construction and maintenance activities in a location to avoid entry into streams. Include these waste areas in soil stabilization planning for the road.

Please refer to the Handbook of Valley County Stormwater BMPs for more BMPs on controlling erosion during the construction process.

Table 1

Road Grade (percent)	Spacing Between Open-Top Culverts, (feet)
2 to 5	300 to 500
6 to 10	200 to 300
11 to 15	100 to 200
16 to 20	<100



Forest roads are often built by excavating the road surface out of a hillside. A bulldozer starts at the top of the cut slope, excavating and sidecasting material until the desired road width is obtained.

BMP Design and Construction

Knowing which BMP to use is half the battle the other half is designing, constructing and installing the BMP. The following guidelines were taken from the Valley County Catalog of Storm Water Best Management Practices. Please refer to this manual when doing any new construction.

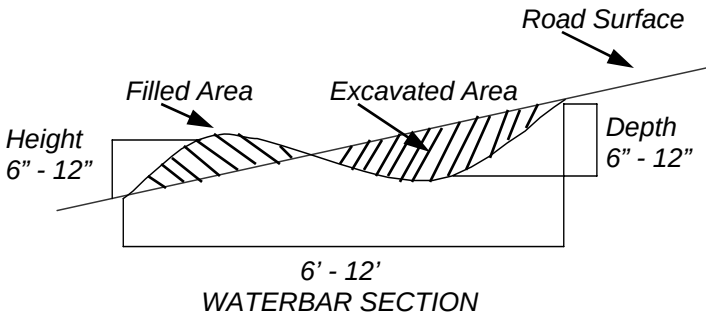
Open-Top Box Culvert: Construct a box-like frame (three-sided, open-topped) of logs; lumber; discarded guardrail; or commercial, corrugated steel. Install it flush with the road surface skewed at an angle downgrade across the roadway. The inflow end should extend 6-12 inches beyond the surface of the roadbed and should be directed onto vegetated ground or riprap or into another erosion control structure such as a sediment trap or catch basin. Install relief open-top box culverts with a minimum cross drainage grade of 2 percent.

Spacing between culverts should be in accordance with recommended cross drainage spacing in Table 1. Where recommended spacing is less than 33 ft, the road should be paved with gravel or crushed rock.

Water bar: A cut and berm built at a downward angle across the roadway, extending from the cutbank to the opposite fill shoulder. Waterbars reduce erosion by diverting storm water runoff from the road surface and directing it to a safe discharge area.

- Construct low enough for traffic to pass over and angle across road to direct runoff flow off the road.
- Proper spacing between water bars can be determined from Table 1.
- Berm 6-12 inches high; Cut 6-12 inches deep, skewed at angle of **30º to 40º across road.**

- A shallow trench, 12 to 18 inches below the surface of the road or trail would extend beyond both sides.
- Discharge: Runoff should be directed onto fill material with proper energy dissipation and drainage away from the fill.



WATERBAR SECTION

Road Crowning: Used as a drainage measure to divert surface water off the entire road surface so that water does not concentrate in any specific location.

- A rounded slope with the high point being the middle of the road with an approximate 1 to 2 percent grade from the middle outward.
- Berms on the outside of the road should be limited or removed to allow water to flow off the road surface.
- Provide sediment collection or erosion-control measures at the toe of the fill slope to prevent excessive erosion and sediment transport.

Rolling Dip: Used as a runoff diversion measure to prevent erosion of the road surface. Rolling dips are effective on long inclines to keep storm water from flowing directly down the road where it may cause gullying and other damage to the road surface and grade.

- Rolling dips are not suitable on road grades steeper than 5 percent. Road must be at least 150 feet long.
- The dip should be 1 foot below the road surface. The upgrade approach to the bottom of the dip should be approximately 66 feet long. The down grade approach to the bottom of the dip should be approximately 23 feet long.

Align the dip across the road at nearly a 90-degree angle and slope it outward 5 percent. Rolling dips are built into the road, during construction, following the natural contours of the land. Install erosion and sediment measures at the low point of the dip (drainage outfall to fillslope) before final grading to direct storm water discharge from the dip. Outflows should be kept free of debris to prevent ponding.

Machine maintenance on your property can result in water contamination. Dispose of used oil, filters, and parts responsibly!

BMPs for Ditches

Ditches are constructed to convey water from storm runoff to an adequate outlet without causing erosion or sedimentation. A good ditch needs to be shaped and lined using the appropriate vegetative or structural material.

Ditches are efficient in the removal of runoff from the road, helping preserve the road bed and banks. Well designed ditches provide an opportunity for sediments and other pollutants to be removed from runoff water before it enters surface waters. A ditch achieves this by controlling, slowing and filtering the water through vegetation or structures. In addition, a ditch must be stable so as not to become an erosion problem itself.

Construction Guidelines:

- Locate ditches on the up slope side of the road to prevent water from flowing onto the road from uphill.
- Size ditches so they are large enough to handle runoff from the drainage area.
- Design and grade ditch and bank side slopes at a maximum 2:1 slope.
- Excavate a ditch deep enough to drain the road base: 1.5 to 2 feet deep.
- The ditch bottom should be parabolic-shaped or at least flat and a minimum of 2 feet wide to help slow and disperse water.
- Line ditches as soon as possible to prevent erosion and to maintain the ditch profile.
- Line ditches which have a less than 5% slope with grass in order to filter sediments.
- Line ditches which have a greater than 5% slope with 2-6 inch diameter rock.
- All ditches need an outlet; standing water weakens roads.

Cleaning and Maintenance:

- Clean ditches when they become clogged with sediments or debris to prevent overflows and washouts.
- Check ditches after major storm events for obstructions, erosion, or bank collapse.
- Re-grade ditches only when absolutely necessary and line with vegetation or stone as soon as possible.

Culvert BMPs

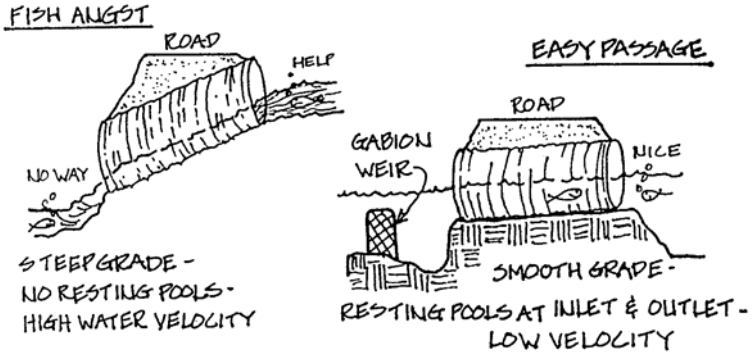
Use fish friendly culverts at stream crossings. Culvert installation should not change the conditions in the stream that existed prior to installation. Trout and other species move upstream and downstream to spawn and meet other habitat needs.

Culverts can impede fish passage by creating the following conditions:

- ⇒ Excessive water velocities
- ⇒ Vertical barrier-fish must jump too high
- ⇒ Inadequate water depth
- ⇒ Icing and debris problems
- ⇒ Culvert design does not accommodate the size and species of fish passing through the structure

The following BMPs are for a fish friendly culvert.

- When crossing a stream, select the culvert site so that there is no sudden increase or decrease in gradient and there is a 50-foot straight alignment of the stream channel directly above the crossing.
- Use bridges, bottomless arches or partially buried culverts in areas where fish passage is an important consideration.
- Design culverts so that water velocities passing through the pipe are equal to water velocities in the stream.
- Provide resting pools at culvert inlet and outlet for culverts installed across streams with high gradients.
- Place riprap securely at upstream culvert end to avoid dislodging that may result in lower culvert capacity, higher velocity flows and reduced inlet efficiency.

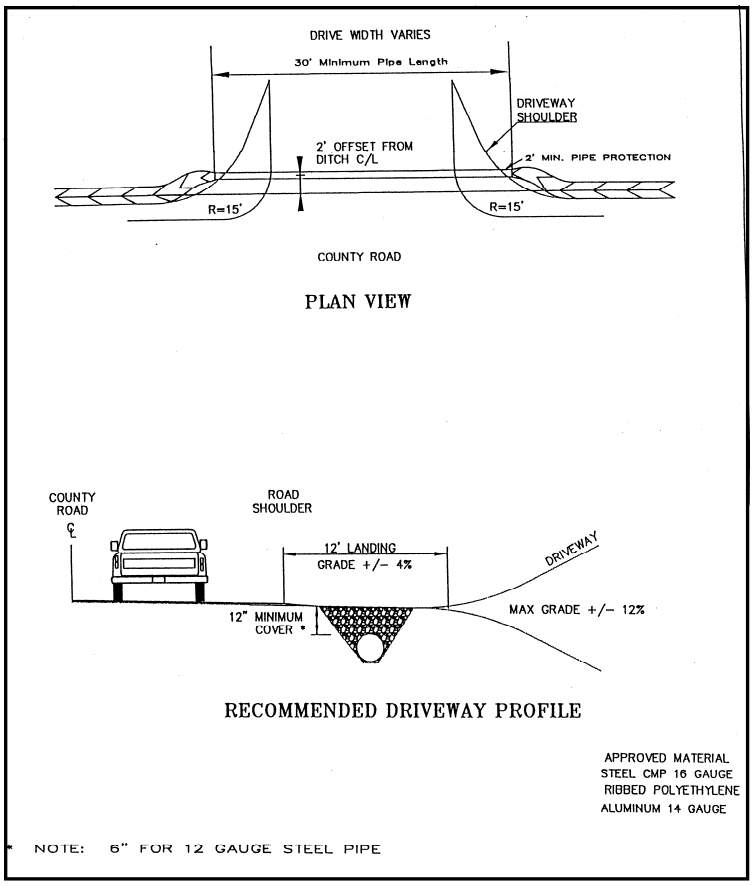


FISH ANGST vs. EASY PASSAGE

Culvert Maintenance & Inspection Chart

Problem	Cause	Solution
Ponded/ puddled water	Culvert bottom is too high. Ditch grade is too flat.	Reset the pipe to match the invert to the channel bottom. Regrade ditch to maintain correct flow.
Dented/ crushed ends	Traffic/snow plows are hitting the ends.	Fix pipe ends; use flared inlets and outlets; mark and protect.
Heavy corrosion	Water flowing through the culvert is acidic.	Install a sleeve of PVC in the existing pipe or replace the steel pipe with non-corrosive material (PVC, polyethylene, aluminum, concrete).
Piping around the outlet	Pipe is incorrectly installed, resulting in water flowing outside the pipe.	Reinstall pipe with proper bedding and compaction; install a headwall or antiseep diaphragm.
Sediment build-up	Not enough slope. Also, check for excess sediment coming from an upstream source.	Reinstall pipe with proper bedding and compaction; install a headwall or antiseep diaphragm.
Sediment build-up	Not enough slope.	Reinstall pipe with a slope of at least 1/4 inch per foot.
Objects blocking the pipe	Debris traveling from the ditch to the culvert.	Remove blockage; install check dams upstream of the culvert.
Sagging bottom	Foundation material has settled or has low bearing capacity.	Reinstall pipe with suitable and properly compacted foundation material.
Crushed top	Not enough cover. Soil around walls not compacted. Traffic loads are too heavy.	Add cover. Reinstall pipe deeper and/or with suitable and properly compacted bedding material.

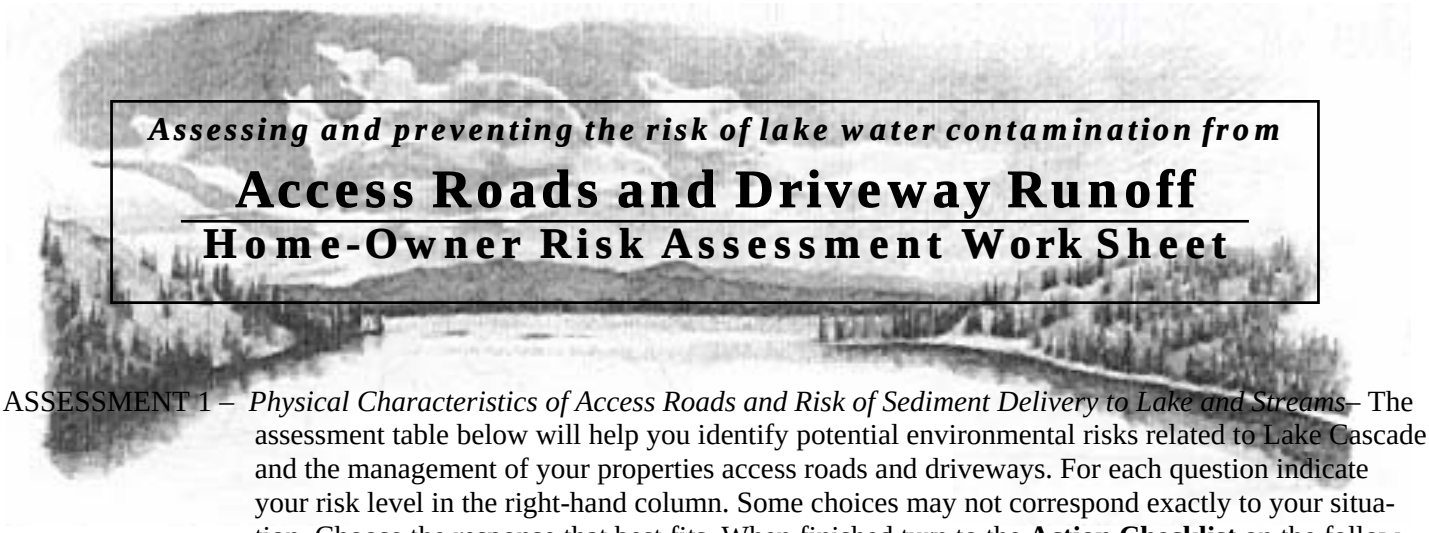
Valley County Driveway Specifications



BMP Maintenance

The best management practices listed previously must be regularly maintained to control erosion. Periodic inspection and maintenance will extend the life of the BMP and keep road maintenance costs down.

- Mark road culverts to aid in location and clean regularly.
- Clean and repair box culverts on a regular basis. **Keep water bars**, and box culverts free of debris and sediment for optimum performance.
- **Avoid using roads during wet periods** if such use would likely damage the road drainage features.
-
- Grade road surfaces only as often as necessary to maintain a stable running surface and to retain the original surface drainage.
- Rolling dips and other outflows should be kept free of debris to prevent ponding.



Assessing and preventing the risk of lake water contamination from

Access Roads and Driveway Runoff

Home-Owner Risk Assessment Work Sheet

ASSESSMENT 1 – *Physical Characteristics of Access Roads and Risk of Sediment Delivery to Lake and Streams*– The assessment table below will help you identify potential environmental risks related to Lake Cascade and the management of your properties access roads and driveways. For each question indicate your risk level in the right-hand column. Some choices may not correspond exactly to your situation. Choose the response that best fits. When finished turn to the **Action Checklist** on the following page and record your medium and high-risk practices. Your goal is to lower your risks. Use the BMP recommendations on pages 1-5 of this brochure and those found in the *Handbook of Valley County Stormwater Best Management Practices*, to help you decide how to best reduce pollution associated with water runoff.

	LOW RISK	MEDIUM RISK	HIGH RISK	YOUR RISK
Access road type, and slope of road to home:	Road paved, or road has good gravel base.	Road compacted dirt, and slope is 0-15%.	Road compacted dirt, and slope is >15%.	❒ Low ❒ Medium ❒ High
Condition of unpaved road into home:	Erosion low; no obvious gullies or road wash channels.	Some signs of erosion with loss of soil.	Erosion evident with deep gullies and wash channels.	❒ Low ❒ Medium ❒ High
Condition of road cut bank (above slope) and fill bank (below slope):	Banks are relatively flat and well vegetated, no obvious signs of erosion.	Banks are steep but well protected with vegetation with only some signs of erosion.	Banks are steep, generally bare, erosion evident with gullies and soil slumps.	❒ Low ❒ Medium ❒ High
Existence and condition of structures for water runoff management:	Drainage ditches deep and vegetated, culverts maintained, water bars or rolling dips present on steep slopes to slow runoff velocity.	Evidence that drainage ditches and culverts are not completely effective in runoff management.	Drainage ditches shallow or flat allowing road wash, culverts plugged or no culverts, road needs water bars or rolling dips.	❒ Low ❒ Medium ❒ High
Fate of water and sediment runoff from roads and road banks:	Most water flows over forested land where sediment can drop out before reaching a stream or lake.	A good deal of water flows directly into the lake or stream; water only slightly turbid (dirty).	Most runoff water is channelized and flows directly into streams or the lake; water is turbid.	❒ Low ❒ Medium ❒ High

ACTION CHECKLIST

Access Roads and Driveway Runoff

Write all high and medium risks below.	**What can you do to reduce the risks?**	**Set a target date for action.**
Sample: Runoff from driveway runs directly into a stream or the lake.	Slow movement of water running down the driveway with culvert boxes that divert storm water into heavily vegetated areas.	One week from today: June 1

Information derived from Lake*A*Syst materials is intended only to provide general information and recommendations to property owners around Lake Cascade regarding their management practices. **All results are confidential.**